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ABSTRACT

The purpose of the research was to determine which community characteristics, among the 29 studied, were statistically most useful as predictors of per-pupil Federal aid to the 169 school districts of Connecticut. Three regression models were developed using community traits as predictors of Federal aid allocations. Community characteristics reflecting need -- as defined by law -- were found to be the best predictors in all three models. A judged rating of the town's organization and aggressiveness in the pursuit of Federal funds was also a significant predictor. Multiple correlaticn coefficients for all models were significant at the .01 level, and cross validation indicated little shrinkage. (Author)

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Prediction of Federal Aid Allocations to Local School Districts in Connecticut

by

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Prediction of Federal Aid Allocations to Local School Districts in Connecticut[1]

Since its inception, the Federal government has engaged in two types of educational activities, financing and administering its own educational programs, and aiding the States and Territories in financing and promoting education. The adoption of the Constitution, with its power to tax and appropriate for the general welfare, has permitted the Federal government to play an increasingly important role in education at the local level. Over two hundred Federal aid to education laws have been passed by Congress since 1785. (NEA, 1967, p.4)

The stated purpose of the Federal legislation in the area of aid to elementary and secondary education has been to equalize educational opportunity for all youngsters throughout the nation. The problem has been to include in the legislation those community characteristics which would reflect the educational needs of the school district. Congress has not been able to isolate and define a single criterion of need, but rather has identified various and different measures of need for a growing number of categoric aid components. As a result, over the years a myriad of Federal aid to education laws have been enacted, each with its unique criteria of need.

Local school districts have thus faced two problems. First, local educational agencies had to be aware of a vast number of Federal aid to education statutes and the State department of education rules and regulations governing allocations. Secondly, once a local district believed itself eligible under law for a certain component of Federal aid, it had to write and have approved a detailed proposal. Administrative time and effort in the pursuit of Federal funds and concern over the criteria employed for their allocation has thus become

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[1] This paper is based upon a portion of the author's doctoral dissertation entitled "The Development of Regression Models using Community Characteristics as Predictors of Federal aid allocations to Connecticut School Districts."

a major concern of educators.

Summarily, the charges of "grantsmanship" have been directed at the public school system, and journals have included numerous articles outlining tips on proposal writing and where to look for money. (American Education, 1968; Phi Delta Kappan, 1968; Burnett, 1967; Lee, 1968)

Purpose of the Study

The purpose of the research was to determine which community characteristics, among the twenty nine studied, were statistically most useful as predictors of per-pupil Federal aid allocations to the towns of Connecticut in fiscal 1968 and 1969. A predictor was operationally defined as useful if its inclusion in the predictive model yielded a multiple correlation coefficient significant at the .05 level.

Method and Techniques

Determination of the community characteristics which act as good predictors was achieved through the development of three regression models, each to predict a certain component or sum of components of per-pupil Federal aid for the 1968 and 1969 fiscal years.

Because the 1968 and 1969 Federal aid allocations were known at the time of the study, the models had perfectly reliable criterion values. Although not the primary purpose of this study, the weights derived from the 1968 and 1969 data on community characteristics can be used to predict future aid allocations when applied to new or projected values of the appropriate community characteristics.

The criterion for each model is listed below:

Model I: Per-pupil aid granted under Title I of the Elementary and Secondary Education Act of 1965.

Model II: Per-pupil aid granted under the sum of all Titles of the Elementary and Secondary Education Act of 1965.

Model III: Per-pupil aid granted under the sum of all major components (15) of Federal aid administered by the Connecticut State Department of Education.

The following three research hypotheses were tested with respect to each of the three models.

1. The community characteristics reflecting need, as defined by law, are significantly correlated with the criterion and are the best predictors of Federal aid allocations.

2. The variable "project director rating" is correlated significantly with the criterion.

3. The multiple correlation coefficient is statistically significant.

This study attempted to measure a variety of community characteristics which were described by law to be indicative of need. These community characteristics (detailed in Appendix A) were then used as predictors of per-pupil Federal aid to elementary and secondary education within each of the one hundred sixty nine towns of Connecticut for the fiscal years 1968 and 1969.

One of the central interests of this study was to determine the relationship between a town's aggressiveness in the pursuit of Federal funds through its project director and the actual amount of Federal aid it was granted. It was hypothesized that the project director rating would correlate significantly with each of the criterion variables. For this reason, it was essential to obtain a reliable measure of this variable.

Five trained judges from the Connecticut State Department of Education rated each town for each of the two years on the status of its project director and its aggressiveness in the pursuit of Federal funds. Inter-judge reliabilities were calculated, and the most reliable pool chosen.

Data were analyzed using the stepwise multiple regression program from the IBM Scientific Subroutine Package (1968). The selection of predictors was allowed to progress until all the predictors were selected.

Empirical cross validation was conducted in the following manner. The predictive equations derived from the fiscal 1968 data were used to predict 1969 allocations, and the predictive equations derived from the fiscal 1969 data were used to retrodict 1968 allocations.

Results

Tables I and 2 lists the output for model I for 1968 and 1969 respectively. Predictors, as defined by law, for Title I allocations were percentage of children receiving A.D.C., percentage of children from low income families, and the number of homes for neglected or delinquent children. These correlated significantly with the criterion in both years.

The variable "project director rating" was also found to be significantly correlated with per-pupil Title I allocations.

Multiple correlation coefficients of .956 for the 1968 model and .964 for the 1969 model were reported. Both were significant at the .01 level.

High correlations between population, average daily membership, number and percentage of children from minority groups and the criterion indicated that higher per-pupil Title I allocations went to urban areas with high concentrations of minority groups.

Tables 3 and 4 list the results for Model II for 1968 and 1969 respectively. Model III had as its criterion the per-pupil Federal aid granted under the sum of all Titles of ESEA. Predictors of need, as defined by law, and their correlations with the criterion for each of the two years, were, percentage of children receiving A.D.C. (.62 and .55), percentage of children from low income families (.51 and .45), number of homes for neglected children (.44 and .34) and Title II library resources rating (.18 and -.04). The Title II correlation with the 1969 data was not significant, but all others were.

Again, project director rating for both years was significantly correlated

(.33 and .29) with the criterion.

Variables of need were selected first. The appearance of regional district rating among the early selections was assumed to be accounting for Title III variance.

The multiple correlation coefficient was .790 for the 1968 model and .672 for the 1969 model. Both were significant at the .01 level.

The third, and final, model developed had as its criterion the total per-pupil Federal aid granted under all major components of aid to elementary and secondary education. Because each component was not funded with equal magnitude, it was expected that variables of need corresponding to the heavily funded components would correlate highly with the criterion and be selected early in the stepwise process.

Tables 5 and 6 show that the need predictors of percentage of children on A.D.C., number of Federal buildings, impacted areas factor, percentage of children from low income families, number of homes for neglected children, and number of home economics personnel, all correlated significantly with the criterion for each of the two years. Two other variables of need, Title II library resources rating and guidance personnel-pupil ratio were unrelated to the criterion.

Project director rating was significantly correlated (.29 and .52) with the criterion.

Multiple correlation coefficients of .870 and .810 for the 1968 and 1969 models respectively were both significant at the .01 level.

Cross Validation Results

Weights derived in the 1968 models from 1968 models data were applied to 1969 data, and 1969 allocations were predicted. These predicted grants were then correlated with actual 1969 grants. The same procedure was used to cross validate the 1969 models. Results are listed in table 7.

Conclusions and Implications

Three predictive models of various components of Federal aid were derived and discussed. It was found that predictors of need, as defined by law, were correlated significantly with the criterion in each model. The same variables were selected first as the most useful predictors of their respective criterion.

The variable "project director rating" was significantly correlated with each criterion. This predictor, if used alone, was able to explain a significant portion of the variance in models I, II, and III.

Regional district rating proved to be the most useful predictor among the variables not defined by law as measuring need.

Empirical cross validation indicated the models had generalizability between the two years of the study.

Certainly this research is to be considered the initial step in the building of predictive models for Federal aid allocations. However, the building of predictive models which seek to simulate human behavior in educational administration is a worthy endeavor which can provide a mirror for self examination and improvement. The successful development of policy equations (Christal, 1968a, p.25; 1968b, p.37) or predictive models indicates that the exercise of policy decisions is consistent. Insofar as the prediction of a criterion cannot be derived from the data available to an administrator or administrative group, then that administrator or group is making unreliable, or essentially random decisions. Further, if the policy of an administrator or board can be captured in a predictive model, then the decision making can be done by simulation, freeing the administrator for more creative endeavors.

TABLE I

Regression Output for Model I; 1968

Step	Variable	Correlation with Criterion	'6' wt	't' value	Mult-R	SE.est.	F-ratio
1.	Percent ADC	.82	1.57	6.06	.819	4.54	341.43
2.	Percent Low Income	.72	1.74	15.11	.931	2.90	541.32
3.	Neglected Children's homes	.55	4.30	5.34	.944	2.64	447.07
4.	Percent minority	.81	-.02	-.15	.947	2.58	353.72
5.	Min. Teacher Salary	.13	-.01	-1.07	.949	2.54	292.51
6.	Project director rating	.46	.88	2.99	.950	2.50	251.79
7.	ADM	.54	.00	-.34	.952	2.48	221.66
8.	Size of Board of Education	.08	.14	1.02	.952	2.47	194.27
9.	No. minority children	.78	.00	2.90	.953	2.47	172.94
10.	No. ADC	.79	-.01	-2.94	.955	2.43	162.54
11.	Type Town Government	.18	.30	1.29	.955	2.42	149.27
12.	Population	.62	.00	-.45	.956	2.42	136.48
13.	Percent unemployed	-.03	.11	.44	.956	2.42	125.45
14.	No. Administrators	.28	.08	.38	.956	2.43	115.88
15.	Ability to Pay	.08	.00	-.30	.956	2.44	107.56
16.	Percent Manufacturing	.06	.00	.26	.956	2.44	100.26
17.	Per-pupil Expenditure	.10	.00	-.11	.956	2.45	93.75
18.	Party in Power	.18	-.03	-.08	.956	2.46	87.96
19.	Regional District rating	-.08	.01	.02	.956	2.47	82.77
20.	No. Low-income	.78	.00	.02	.956	2.48	78.11**

Intercept 8.75
Correlations significant at .05 level if 7/.15
** Significant at .01 level

TABLE 2

Regression Output for Model I; 1969

Step	Variable	Correlation with Criterion	'6' wt	't' value	Mult-R	SE.est.	F-ratio
1.	Percent ADC	.90	1.42	10.44	.901	3.10	724.45
2.	Percent Low Income	.81	1.14	11.90	.953	2.13	816.28
3.	Project Director rating	.39	.68	2.73	.957	2.08	605.12
4.	Percent Manufacturing	.09	-.01	-.98	.959	2.05	469.70
5.	Percent minority	.73	.21	2.79	.960	2.02	384.54
6.	ADM	.46	.00	-.62	.961	2.02	322.13
7.	Party in Power	.20	-.43	1.39	.961	2.02	276.26
8.	Type Town Government	.18	.15	.82	.961	2.02	242.48
9.	Percent unemployed	-.03	.14	.74	.961	2.02	215.54
10.	No. Minority Children	.72	.00	-2.59	.962	2.02	193.56
11.	No. ADC	.70	.01	2.68	.963	2.00	180.21
12.	Neglected children's homes	.56	-1.03	-1.50	.963	1.99	167.31
13.	Minimum Teacher Salary	-.05	.00	1.19	.963	1.99	154.11
14.	Ability to Pay	.10	.00	-1.72	.964	1.92	143.87
15.	Per-pupil Expenditure	.08	.00	.69	.964	1.99	134.14
16.	Population	.54	.00	.63	.964	1.99	125.37
17.	Regional District Rating	.01	.12	.42	.964	2.00	117.50
18.	No. Administrators	.28	-.49	-.31	.964	2.00	110.33
19.	Size of Board of Ed.	.12	-.02	-.18	.964	2.01	103.85
20.	Number Low Income	.73	.00	-.10	.964	2.01	98.00**

Intercept 11.47
Correlations significant at .05 level if 7/.15
** Significant at .01 level

TABLE 3

Regression Output for Model II; 1968

Step	Variable	Correlation with Criterion	'6' wt	't' value	Mult-R	SE.est.	F-ratio
1.	Percent low income	.65	2.32	6.63	.646	8.59	119.65
2.	Percent ADC	.62	2.06	2.66	.722	7.81	90.39
3.	Regional District Rating	.14	1.03	1.05	.742	7.58	67.56
4.	Neglected children's homes	.44	4.22	1.76	.750	7.50	52.86
5.	Ability to Pay	.01	.00	-1.89	.756	7.45	43.50
6.	Project Director Rating	.33	2.20	2.48	.759	7.44	36.69
7.	ADM	.24	.00	-1.61	.768	7.34	32.98
8.	Size of Board of Ed.	.11	.59	1.45	.771	7.31	29.39
9.	Title II rating	.18	-.38	-1.30	.776	7.27	26.76
10.	Number minority children	.52	.01	1.94	.779	7.26	24.31
11.	Type Town Government	.07	1.25	1.82	.780	7.26	22.23
12.	Party in Power	.08	-1.72	-1.50	.783	7.24	20.63
13.	Number low income	.50	-.01	-1.37	.785	7.24	19.11
14.	Population	.32	.00	.97	.786	7.25	17.74
15.	Percent minority	.51	-.44	-1.22	.787	7.26	16.57
16.	No. ADC	.52	-.01	-.83	.788	7.26	15.54
17.	No. administrators	.12	.59	.88	.789	7.27	14.63
18.	Minimum Teacher Salary	-.08	.00	-.55	.789	7.29	13.76
19.	Percent Manufacturing	.01	.01	.45	.790	7.31	12.98
20.	Percent unemployed	.00	-.27	-.37	.790	7.33	12.26
21.	Per-pupil Expenditure	.09	.00	.23	.790	7.35	11.61**

Intercept 21.22
Correlations significant at .05 level if 7/.15
** Significant at .01 level

TABLE 4

Regression Outputs for Model II; 1969

Step	Variable	Correlation with Criterion	'6' wt	't' value	Mult-R	SE.est.	F-ratio
1.	Percent ADC	.55	2.65	4.05	.552	10.17	73.01
2.	Title II Rating	-.04	-1.19	-3.05	.610	9.69	49.19
3.	Regional District Rating	.17	1.97	1.60	.636	9.46	37.44
4.	Percent low income	.37	.78	1.70	.645	9.41	29.21
5.	Ability to Pay	.02	.00	-1.03	.652	9.36	24.07
6.	Project Director Rating	.29	2.28	1.90	.689	9.32	20.71
7.	ADM	.19	.00	-.66	.664	9.29	18.16
8.	Party in Power	.02	-.98	-.66	.665	9.30	15.88
9.	Number low income	.41	-.01	-.73	.666	9.32	14.10
10.	No. ADC	.47	.01	.64	.667	9.34	12.68
11.	Neglected children's homes	.34	-2.89	-.86	.669	9.35	11.54
12.	Percent minority	.45	-.18	-.49	.670	9.37	10.57
13.	Population	.26	.00	.53	.670	9.39	9.74
14.	Type Town Government	.00	.34	.39	.671	9.42	9.01
15.	Size of Board of Ed.	-.02	.19	.37	.671	9.44	8.37
16.	Percent unemployed	.03	.24	.27	.672	9.47	7.80
17.	Number Administrators	.00	.13	.17	.672	9.50	7.30
18.	Minimum Teacher Salary	.02	.00	-.20	.672	9.53	6.85
19.	Number minority	.46	.00	-.13	.672	9.56	6.45
20.	Percent Manufacturing	-.05	.01	.14	.672	9.60	6.10
21.	Per-pupil Expenditure	.13	.00	.11	.672	9.63	5.76**

Intercept 18.98
Correlations significant at .05 level if 7/.15
** Significant at .01 level

TABLE 5

Regression Output for Model III; 1968

Step	Variable	Correlation with Criterion	'6' wt	't' value	Mult-R	SE.est.	F-ratio
1.	Impacted areas factor	.68	.15	.76	.676	12.96	140.74
2.	Percent low income	.45	2.39	5.25	.785	10.93	133.30
3.	Percent ADC	.44	2.11	2.11	.811	10.35	105.86
4.	Regional District Rating	.04	.84	.66	.822	10.12	85.11
5.	Neglected children's homes	.28	7.42	2.34	.826	10.04	70.05
6.	ADM	.27	.00	-2.51	.832	9.92	60.56
7.	Project Director Rating	.29	3.05	2.61	.839	9.76	54.56
8.	Size of Board of Ed.	.15	1.22	2.25	.845	9.62	49.77
9.	Percent minority	.45	-.36	-.68	.850	9.51	45.83
10.	Number administrators	.25	1.97	2.23	.853	9.45	42.04
11.	Title II Rating	.12	-.52	-1.31	.854	9.45	38.40
12.	Ability to Pay	-.02	.00	-1.47	.855	9.44	35.31
13.	Party in Power	.03	-2.96	-1.88	.856	9.44	32.66
14.	Type Town Government	.16	1.53	1.64	.857	9.43	30.49
15.	Number low income	.41	-.04	-2.95	.858	9.43	28.53
16.	Number minority	.41	.02	2.87	.862	9.35	27.44
17.	Number ADC	.38	-.02	-1.76	.864	9.31	26.19
18.	Population	.29	.00	1.60	.866	9.29	24.98
19.	Parents L & W	.61	-.11	-.54	.869	9.22	24.15
20.	Minimum Teacher Salary	-.02	.00	-.67	.869	9.24	22.86
21.	Parents working	.47	-.04	-.43	.869	9.27	21.67
22.	Home Economics Personnel	.27	.22	.36	.870	9.29	20.58
23.	Number Federal Buildings	.40	.31	.25	.870	9.32	19.56
24.	Per-pupil Expenditure	.02	.00	.30	.870	9.35	18.63
25.	Percent Manufacturing	.08	.01	.23	.870	9.38	17.77
26.	Guidance Ratio	.00	.00	.03	.870	9.42	16.96
27.	Percent unemployed	-.06	.02	.02	.870	9.45	16.22**

Intercept 34.68
Correlations significant at .05 level if 7/.15
** Significant at .01 level

TABLE 6

Regression Output for Model III; 1969

Step	Variable	Correlation with Criterion	'6' wt	't' value	Mult-R	SE.est.	F-ratio
1.	Impacted areas factor	.61	1.99	.53	.614	13.69	100.98
2.	Percent ADC	.46	2.92	3.85	.739	11.73	99.69
3.	Regional District Rating	.05	1.84	1.29	.760	11.34	75.28
4.	Title II Rating	.02	-1.08	-2.35	.771	11.16	59.92
5.	Guidance ratio	-.10	-.01	-1.88	.776	11.07	49.46
6.	Number low income	.39	-.02	-1.26	.781	11.00	42.22
7.	Project Director Rating	.32	3.33	2.33	.789	10.86	37.82
8.	ADM	.26	.00	-.66	.794	10.77	34.12
9.	Party in Power	.13	-2.04	-1.14	.797	10.75	30.68
10.	Percent unemployed	.00	1.28	1.17	.799	10.72	27.90
11.	Size of Board of Ed.	.06	.84	1.42	.802	10.69	25.73
12.	Ability to Pay	-.04	.00	-.68	.804	10.68	23.72
13.	Percent low income	.31	.63	1.17	.805	10.68	21.94
14.	Number minority	.40	.00	-.45	.806	10.69	20.40
15.	Parents L & W	.55	-1.95	-.52	.807	10.69	19.10
16.	Number administrators	.16	.69	.74	.808	10.71	17.88
17.	Number Federal buildings	.34	-.05	-.02	.808	10.74	16.75
18.	Neglected children's homes	.30	-3.41	-.82	.809	10.77	15.76
19.	No. ADC	.40	.01	.80	.809	10.79	14.86
20.	Percent minority	.43	.46	.72	.810	10.82	14.06
21.	Parents working	.43	-.97	-.52	.810	10.84	13.35
22.	Per-pupil Expenditure	.05	.00	-.25	.810	10.88	12.67
23.	Population	.29	.00	.18	.810	10.91	12.04
24.	Home Economics Personnel	.27	.07	.09	.810	10.95	11.46
25.	Type Town Government	.12	-.09	-.09	.810	10.99	10.92
26.	Percent Manufacturing	.06	.00	-.03	.810	11.03	10.43
27.	Minimum Teacher Salary	.02	.00	-.01	.810	11.07	9.97**

Intercept 16.13
Correlations significant at .05 level if 7/.15
** Significant at .01 level

TABLE 7

Cross Validation of 1968 and 1969 Models

	1968		1969	
	Mult-R	Cross Validated	Mult-R	Cross Validated
Model I	.956	.940	.964	.920
Model II	.790	.600	.672	.620
Model III	.870	.740	.810	.670

APPENDIX A

Definition of Predictor Variables

I. Variables of Need as Defined by Law

1) Number of children between the ages of five and seventeen in families receiving A.D.C.

2) Percentage of children in the local school district receiving A.D.C.

3) Number of Federal buildings or properties which are tax exempt under P.L. 81-874

4) Number of children whose parents live and work on Federal property located in the local school district

5) Number of children whose parents work on Federal property located in the local school district

6) Impacted areas factor: one-half (5) plus (4)

7) Number of children from low-income families

8) Percentage of children from low-income families

9) Number of homes for delinquent or neglected children

10) Number of home economics personnel

11) Title II Library Resources Rating - based on State Department rating of various library-media inventories

12) Guidance personnel-pupil ratio

II. Other Community Characteristics used as Predictors

1) Number of children from minority groups

2) Percentage of children from minority groups

3) Population

4) Average daily membership (ADM)

5) Per-pupil Expenditure

6) Ability to Pay: net grand list divided by ADM

7) Type of town government - categorical vector to represent the governing type of a town

8) Political party in power: categorical vector, Republican (1), Democrat (2), Independent (3)

9) Number of members on the Board of Education

10) Project Director Rating: a judged rating of the status, organization, and aggressiveness of the local school districts pursuit of Federal funds. A four-point scale was used.

11) Regional District Status: a three-point scale to represent the degree of participation in regionalized school efforts

12) Administrative staff: number of central office administrative personnel

13) Minimum starting salary for teachers

14) Level of unemployment

15) Percentage of work force in manufacturing occupations

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